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Handbook
Operation and Service Instructions
with
Illustrated Parts Breakdown

INVERTER TEST SET
TS-1409/U

(Bruno-New York Industries Corporation)

PUBLISHED BY DIRECTION OF
THE CHIEF OF THE BUREAU OF NAVAL WEAPONS

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1 February 1961

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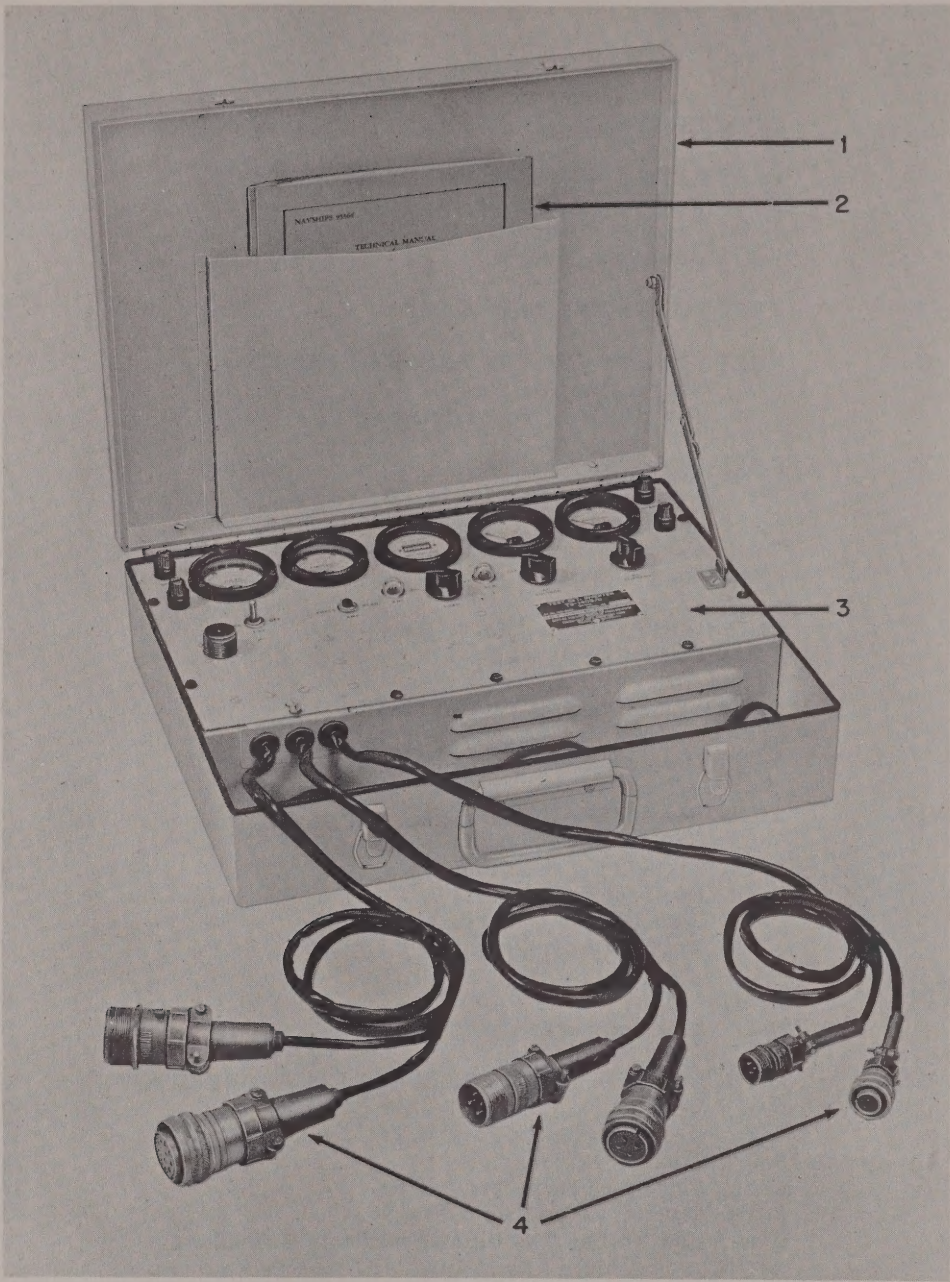
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Figure 1-1. Inverter Test Set TS-1409/U

INTRODUCTION

This handbook contains Operation and Service Instructions With Illustrated Parts Breakdown for Inverter Test Set TS-1409/U as manufactured by Bruno-New York Industries Corporation under Contract No. N600(17)53364. The test set is generally designed for testing 100-v and 250-v aircraft inverters, and specifically to test types MS-25093, E-1616, E-1617, and E-5109 aircraft inverters either installed in an aircraft or in a maintenance shop.

SECTION I

DESCRIPTION AND LEADING PARTICULARS

1-1. DESCRIPTION OF TEST SET.

1-2. CASE AND COVER ASSEMBLY. The test set, as shown by figure 1-1, is housed in a welded steel case with a continuous hinged cover and folding handle. The cover of the case is provided with a brace to hold it open in the proper position, and two toggle latches to hold the cover closed. A compartment in the cover provides space for this Handbook of Operation and Service Instructions With Parts Breakdown. The case and cover has a yellow enamel finish and is provided with nine rubber feet; five on the bottom, and four on the rear side. The case is vented with flame-proof screened louvers. Space is provided in front of the control panel mounted in the case for the storage of the three cables of the test set. The case is 18 inches long, 15 inches deep, and 5 inches high; it weighs (with control panel and cables) approximately 25 pounds.

1-3. CONTROL PANEL ASSEMBLY. The control panel is constructed of 14-gage steel and is fastened to the case with machine screws so that it can be easily removed from the case. The front of the control panel (figure 4-1) mounts four fuses, five meters, two indicator lights, five switches, and a connector jack all of which are listed in the legend of figure 4-1 and described in Table I. The rear of the control panel mounts the load resistors (par. 1-4) and other items listed in the legend of figure 7-1.

1-4. LOAD RESISTORS. There are six load resistors in the test set and they are mounted on the rear of the

control panel (figure 7-1). These are non-inductive resistors within 2 percent of each other by virtue of their 1 percent tolerance for each. The resistors R3, R4, and R5 (22, 23, 24) are connected to form a 3-phase delta load of 100 va. The resistor R6, R7, and R8 (26, 27, 28) are likewise connected to form a 3-phase delta load of 250 va. All resistors are listed and described in Table I.

1-5. CABLE ASSEMBLIES. The test set is provided with three cable assemblies each 4-feet long (19, 20, 21, figure 7-1). Each cable assembly is made up of the continuation of the internal wiring of the test set and has two connector plugs on the free end (see Table I). The cable assemblies are permanently attached at the control panel by means of clamps thus preventing the cables from being pulled off the control panel. The cables are covered with black vinyl sleeving.

1-6. LEADING PARTICULARS OF TEST SET.

1-7. Leading particulars of the test set are given in Table I.

1-8. ADDITIONAL MODELS.

1-9. This publication comprises service instructions only for Inverter Test Set TS-1409/U and Contract No. N600(17)53364. Service instructions for additional models when produced will be covered by the use of Different Data Sheets.

TABLE I. LEADING PARTICULARS OF INVERTER TEST SET TS-1409/U

Item	Characteristic
CONTROL PANEL:	
D-C Voltmeter, M1	0-35 volts scale.
D-C Ammeter, M2	0-35 amperes scale.
Frequency Meter, M3	380-420 cycles, 9 reed.
A-C Voltmeter, M4	0-150 volts scale, 400 cycles.
A-C Ammeter, M5	0-1.5 amperes scale, 400 cycles.
Fuse, F1	1.5 ampere.
Fuse, F2	30 ampere, Slo-Blo.
POWER Switch, S1	3-position toggle switch.
LOAD VOLT-AMPERE Switch, S2	5-position selector switch.
CABLE SELECTOR Switch, S3	3-position selector switch for selecting appropriate cable.
AC VOLTAGE-CURRENT Switch, S4	5-position selector switch for reading a. c. amperes and voltage.
DC AMP Switch, S5	Momentary pushbutton switch for reading d. c. amperes.
ACB Indicator Light, DS1	For checking out phase ACB.
ABC Indicator Light, DS2	For checking out phase ABC.
Connector Jack, J1	For making external power connections, Type No. MS3102A16-11P.
LOAD RESISTORS:	
R3, R4, and R5	396.75 ohms each for a 100-v _a load.
R6, R7, and R8	158.7 ohms each for a 250-v _a load.
CABLE ASSEMBLIES (See paragraph 1-5):	
Cable 1	
Connector Plug P1	Type MS-3107A24-20S
Connector Plug P2	Type MS-3101A24-20P
Cable 2	
Connector Plug P3	Type MS-3107A20-4S
Connector Plug P4	Type MS-3101A20-4P
Cable 3	
Connector Plug P5	Type MS-3107A14S-7S
Connector Plug P6	Type MS-3101A14S-7P
INSTRUMENT ACCURACY:	
A-C and D-C Voltmeters and Ammeters.	± 2 percent of full scale.
Frequency Meter	± 1 cycle.
DIMENSIONS:	18 inches long, 15 inches deep, and 5 inches high.
WEIGHT:	25 pounds (approx).

SECTION II

TEST EQUIPMENT AND TOOLS

No special test equipment or special tools are required for servicing the Inverter Test Set TS-1409/U.

SECTION III

PREPARATION FOR USE AND RESHIPMENT

3-1. PREPARATION FOR USE.

3-2. UNPACKING. The Inverter Test Set TS-1409/U is shipped in a paper carton. Unpack carefully so as not to damage the equipment. If the equipment is damaged in any way report such fact at once.

3-3. SET-UP FOR USE. The test set is supplied with three cables each having two connector plug terminals (paragraph 1-5). Only one cable is used at a time. If Cable 1 is used connect P1 to the aircraft inverter to be tested and P2 to the aircraft power supply connection thus placing the test set in series with the aircraft inverter. Make similar connections for P3 and P4 when Cable 2 is used, and for P5 and P6 when Cable 3 is used. Set CABLE SELECTOR switch (13, figure 4-1) to appropriate cable. Do not throw the POWER switch (16) to either LINE or EXT position (par. 4-4) until

the CABLE SELECTOR switch is set to proper cable. The three cables of the test set are so wired to the six connector plugs that an external load cannot be applied to either the Type E-5109-2 or Type MS-25093 aircraft inverters. When all connections are made the test set is ready for use.

3-4. PREPARATION FOR RESHIPMENT.

3-5. When the test set is to be reshipped put the cables in the compartment in the case provided for them and make sure they are fastened in position with the three straps. Be sure also the instruction handbook is placed in the cover compartment. Pack the unit in a paper carton, and provide ample cushioning packing around all sides of the unit. Finally, make sure the carton has proper identifying labels on it.

SECTION IV

OPERATION INSTRUCTIONS

4-1. PRELIMINARY PROCEDURE.

4-2. Depending upon what type of aircraft inverter is to be tested make connections to the Inverter Test Set TS-1409/U as instructed in paragraph 3-3. Then proceed to make tests as covered by paragraphs 4-3 through 4-10.

4-3. STARTING.

4-4. To start the aircraft inverter, in order to make test readings, throw the POWER switch (16, figure 4-1) to the LINE position, or EXT position if power is supplied for bench set up through connector jack (17).

4-5. OPERATION READINGS.

4-6. The input voltage to the aircraft inverter is read on the d. c. voltmeter (3, figure 4-1). The input current is read on the d. c. ammeter (4) by pressing the DC AMP switch (15).

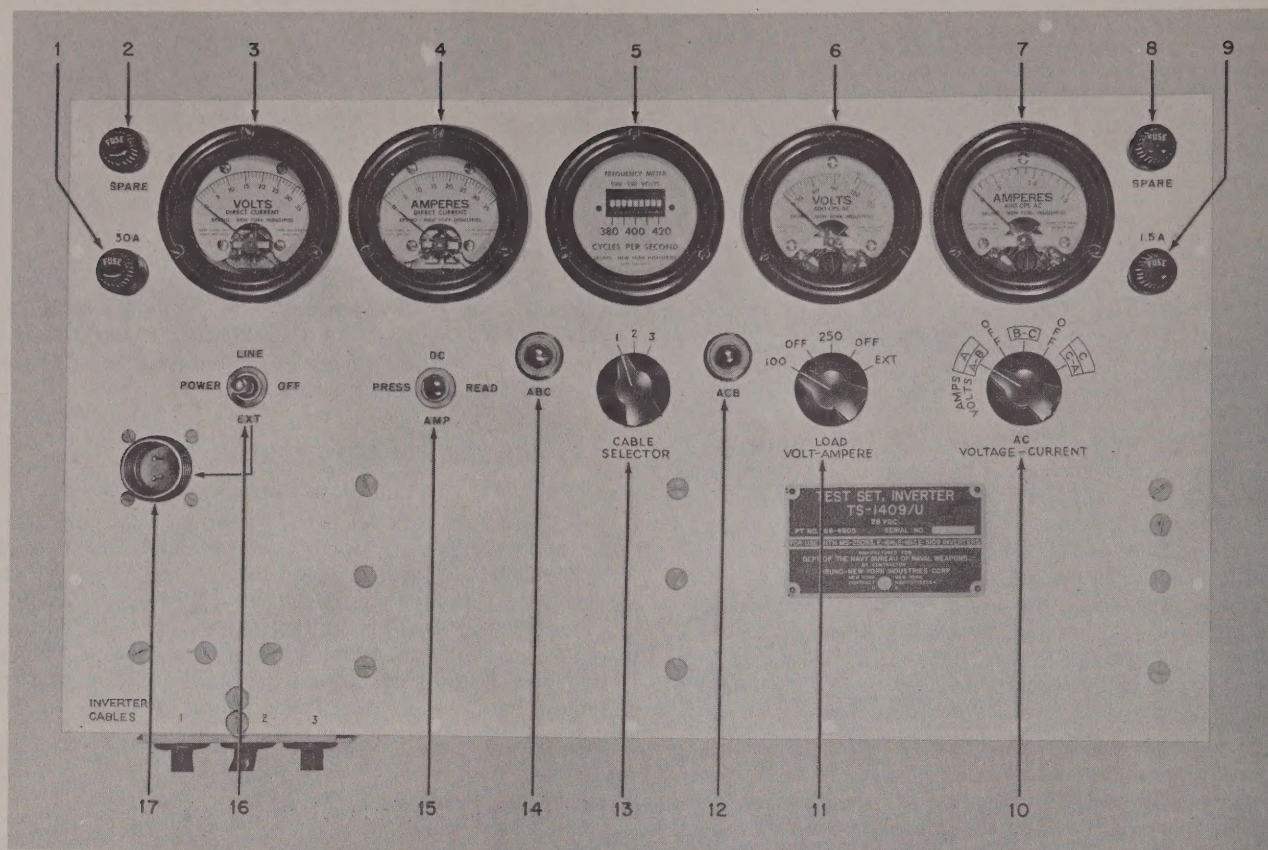
4-7. The output a. c. voltage of the aircraft inverter is read on the a. c. voltmeter (6), and the output a. c.

current on the a. c. ammeter (7). The sequence of voltage readings for each phase is selected by turning the AC VOLTAGE-CURRENT switch (10) to the desired phase. The frequency is read on the frequency meter (5). The phase sequence is indicated by either the ABC indicator light (14) for phase ABC, or the ACB indicator light (12) for phase ACB.

4-8. To put any load on the aircraft inverter turn the LOAD VOLT-AMPERE switch (11) to the required load. This switch connects resistors R3, R4, and R5 (22, 23, and 24, figure 7-1) into the circuit for a 100-va load, and resistors R6, R7, and R8 (26, 27, and 28) for a 250-va load. The switch (11, figure 4-1) is so wired that a 250-va load cannot be applied to a 100-va aircraft inverter. The EXT load position of the selector switch (11) connects the external load when desired to check load of aircraft to inverter, but not for MS25093 type inverters.

4-9. STOPPING.

4-10. To stop the aircraft inverter throw the POWER switch (16, figure 4-1) to the OFF position.



- | | |
|--|-----------------------------------|
| 1. 30A Fuse, F1 | 10. AC VOLTAGE-CURRENT Switch, S4 |
| 2. SPARE Fuse, 30 ampere | 11. LOAD, VOLT-AMPERE Switch, S2 |
| 3. D.C. Voltmeter, 0-35 volts, M1 | 12. ACB Indicator Light, DS1 |
| 4. D.C. Ammeter, 0-35 amperes, M2 | 13. CABLE SELECTOR Switch, S3 |
| 5. Frequency Meter, 380-400 cycles, M3 | 14. ABC Indicator Light, DS2 |
| 6. A.C. Voltmeter, 0-150 volts, M4 | 15. DC AMP Switch, S5 |
| 7. A.C. Ammeter, 0-1.5 amperes, M5 | 16. POWER Switch, S1 |
| 8. SPARE Fuse, 1.5 ampere | 17. Connector Jack, J1 |
| 9. 1.5A Fuse, F2 | |

Figure 4-1. Control Panel, Front View

SECTION V

THEORY OF OPERATION

5-1. CIRCUIT DESIGN.

5-2. The circuit of the Inverter Test Set TS-1409/U is shown by the schematic diagram, figure 8-1. It is a simple circuit consisting essentially of meters, switches, and load resistors designed to test inverters installed in an aircraft. When the proper cable of the test set is connected to the aircraft inverter and to the aircraft power supply (paragraph 3-3) the following

voltages, current, frequency, and phase sequence can be measured the same as if individual meters were used to make each measurement:

- Input d.c. voltage
- Input d.c. current
- Output a.c. voltage
- Output a.c. current
- Frequency
- Phase sequence, ACB or ABC

SECTION VI
ORGANIZATIONAL MAINTENANCE

WARNING

Before performing service work of any kind be sure that all electric power lines from the aircraft power supply circuit, and the aircraft inverter to the test set, are disconnected. Observe all safety precautions when servicing the equipment.

CARELESSNESS CAN RESULT IN SERIOUS INJURY!

6-1. PERIODIC INSPECTION.

6-2. To maintain the Inverter Test Set TS-1409/U at its optimum performance at all times a periodic inspection of the equipment should be made in accordance with the schedule given in Table II-Periodic Inspection Chart. This table indicates "What to Check", "How to Check", and "Precautions". By making careful inspections and performing such maintenance work as is indicated by Table II and paragraphs 6-3 through 6-13 the possibilities of failure of the equipment will be greatly reduced.

6-3. MAINTENANCE PROCEDURES.

6-4. GENERAL PROCEDURE. The maintenance and service work instructions given in this Section VI are limited to such work as can be done without disassembly or partial disassembly only. Accordingly, the instructions are confined to cleaning, touch-up painting, the replacement of fuses, phase indicator lamps and control knobs, and the minor repair of cables. If further repairs are necessary refer to Section VII - Field Maintenance for the procedure to follow.

6-5. CLEANING METHODS. Use only clean lint-free dry cloth for cleaning purposes. Low-pressure compressed air (not over 40 psi) can be used to clean interior parts. When cleaning the control panel be careful not to damage or break the glass of the meters. Take care also not to damage the control knobs or panel markings. When cleaning parts inside the test set be careful not to damage the wiring. Never use a damp cloth to clean electrical wiring. If dirt or corrosion exists on the case of the test set that cannot be removed with a dry cloth employ one moistened slightly with solvent (Cleaning Compound Federal Stock No. 7930-395-9542). For dirt and corrosion that cannot be removed with solvent alone, use crocus cloth and solvent, then after such cleaning, reclean with solvent and wipe dry. Never use steel wool to clean any part; minute particles of the steel wool may get into the equipment causing damage to both mechanical and electrical parts.

6-6. TOUCH-UP PAINTING. If the case of the test set becomes badly scarred or damaged, rust and corrosion can be prevented by touch-up painting. Clean the damaged spots down to a smooth bare surface using No. 00 or 000 sandpaper (never use steel wool) and then do the necessary touch-up painting. Use only an approved and authorized paint.

6-7. ATTACHING PARTS. When inspecting the equipment always check and make certain that all screws, bolts, and nuts fastening the component parts together are tight and secure. Loose parts quickly lead to more serious faults requiring extensive repairs. When tightening screws, bolts, and nuts do not tighten beyond a firm fit.

6-8. REPLACEMENT OF FUSES. If either of the fuses (1 or 9, figure 4-1) need to be replaced turn the cap of the fuseholder counterclockwise and remove the blown fuse. Install new fuse of the proper rating (see Table I) and replace cap of the fuseholder. When replacing fuses always see that a good fuse of the proper rating is also installed in the spare fuseholder (2 and 8).

6-9. REPLACEMENT OF PHASE INDICATOR LAMPS. If either of the phase indicator lamp (12 or 14, figure 4-1) need to be replaced remove the white plastic dome over the lamp by unscrewing the dome counterclockwise. Install new lamps of the proper rating (see Table I) and replace the dome.

6-10. CONTROL KNOBS. If any of the control knobs on the switches (10, 11, and 13, figure 4-1) are found to be damaged or broken replace them with new ones. Make sure the pointer of the new knob is correctly positioned and that the knob is securely fastened by the setscrew in the knob to the shaft on which it is mounted.

6-11. CONTROL PANEL PARTS. If any of the meters, switches, or connector jack mounted on the control panel (figure 4-1) are found to be damaged do not attempt to repair them but install new parts. This work must be done only as directed by paragraph 7-7.

TABLE II. PERIODIC INSPECTION CHART

<p style="text-align: center;"><u>SAFETY NOTICE</u></p> <p>Before making inspections or doing service work of any kind, refer to WARNING notice at the beginning of this Section VI.</p>		
What to Check	How to Check	Precautions
MONTHLY		
1. Operation Check.	a. Follow operation instructions given in Section IV.	a. If test set does not function properly make repairs or replacements indicated by faulty operation only as directed by paragraph 6-4.
2. Exterior of Test Set.	a. Inspect all the items listed in the legends of figures 1-1 and 4-1. Make a check list of all items requiring service work. b. Visually inspect for dirt and corrosion. Look also for scarred or damaged painted surfaces. c. Check for loose screws, bolts, and nuts attaching all parts. d. Check for blown or defective fuses. e. Check for burned out or defective phase indicator lights. f. Check for loose or broken control knobs. g. Check for defective meters, switches, and connector jack. h. Check for defective cables and connector plugs.	a. Perform service work only to the extent directed by the reference paragraphs listed below. b. Clean as directed by paragraph 6-5. If necessary, do touch-up painting as directed by paragraph 6-6. c. Tighten as necessary; refer to paragraph 6-7. d. Replace fuses; refer to paragraph 6-8. e. Replace lamps; refer to paragraph 6-9. f. Tighten or replace knobs; refer to paragraph 6-10. g. Refer to paragraph 6-11. h. Repair or replace as necessary; refer to paragraph 6-12.
QUARTERLY		
3. Interior of Test Set.	a. Inspect all the items listed in the legend of figure 7-1. Make a check list of all items requiring service work. b. Check for dirt and corrosion. c. Check for defective resistors, switches, fuseholders, indicator phase light sockets, and connector jack. d. Check for broken or damaged wiring cables, and connector plugs.	a. Perform service work only to the extent directed by the reference paragraphs listed below. b. Clean as directed by paragraph 6-5. c. Refer to paragraph 7-7. d. Refer to paragraph 7-10.

6-12. **CABLES.** If the covering of any of the three cables (19, 20, and 21, figure 7-1) of the test set become worn make repairs with friction tape. If any of the connection plugs (P1 thru P6) on the cables are damaged they can be replaced (see Table I). If the cables need replacement the work must be done only directed by paragraph 7-10.

6-13. **INTERIOR PARTS.** If any of the resistors, switches, fuseholders, phase light sockets, or connector jack, mounted on the rear of the control panel (figure 7-1) are found to be defective do not attempt to repair them but install new parts. This service work must be done only as directed by paragraph 7-7.

SECTION VII

FIELD MAINTENANCE

WARNING

Before doing trouble shooting or service work of any kind on the test set, read the WARNING notice at the beginning of Section VI - and follow the instructions!

7-1. GENERAL PROCEDURE.

7-2. Failure of the Inverter Test Set TS-1409/U to operate properly will usually be caused by one or more of the following faults:

- a. Failure of the aircraft inverter power supply line.
- b. Failure of the aircraft inverter to deliver an output.
- c. Blown fuses in inverter test set.

Accordingly, when failure occurs, and the cause is not immediately apparent, the serviceman should first check the above items before starting a detail examination of the electrical circuits of the test set. If possible, the serviceman should obtain from the operator of the test set information regarding performance at the time trouble occurred.

7-3. Before attempting to do any trouble shooting or repair work the serviceman should be thoroughly familiar with the purpose, use, and operation of the test set. Such information is given in the Introduction and Section I, IV, V, VI, and VII of this handbook.

7-4. TROUBLE SHOOTING CHART.

7-5. As an aid in trouble shooting the most commonly encountered failures (aside from those given in paragraph 7-2) are listed in Table III - Trouble Shooting Chart. This table lists the "Trouble", "Probable Cause", and "Remedy". By using this chart the serviceman should be able to trouble shoot and correct the most commonly occurring faults.

7-6. When using the trouble shooting chart the serviceman should also refer to the photographic illustrations figures 1-1, 4-1, and 7-1 showing the location of all parts; and also to the schematic and wiring diagrams, figures 8-1 and 8-2, showing the relationship of the parts.

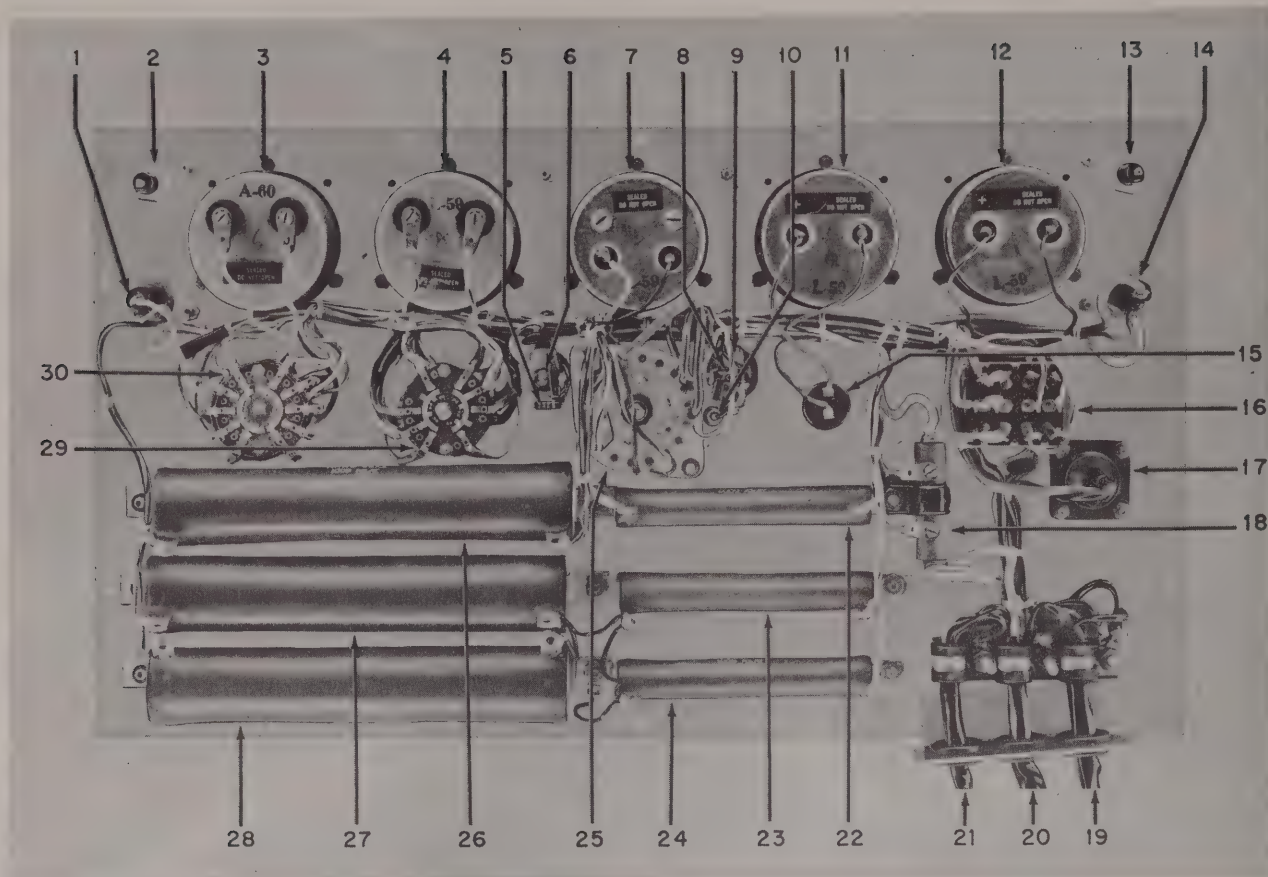
7-7. REPLACEMENT OF PARTS.

7-8. If the electrical parts (except wiring and cables) of the test set are found to be defective do not attempt to repair them but install new parts. When doing such service work reference should be made to the Illustrated Parts Breakdown, given in Sections IX through XII of this handbook, for the type of part to use.

7-9. The method of disassembly and reassembly of parts is obvious, and hence no detail instructions are necessary, except that when making soldered connections make sure the connection is a good one, for a poorly soldered connection is a fault difficult to find and can easily lead to future failure.

7-10. REPLACEMENT OF CABLE ASSEMBLIES AND CONNECTOR PLUGS.

7-11. If the cable assemblies and connector plugs (par. 1-5) of the test set are found to be defective they should be replaced with new ones. Use only No. 14, 16, or 20 stranded type MW wire as per MIL-W-76A, as initially used in wiring the test set and connector plugs as listed in Table I. See also paragraph 1-5 for the method of attaching cables to the control panel.



- | | |
|--|-----------------------------------|
| 1. Fuseholder XF2 for 1.5A Fuse | 16. POWER Switch, S1 |
| 2. SPARE Fuseholder XF2 for 1.5A Fuse | 17. Connector Jack, J1 |
| 3. A. C. Ammeter, 0-1.5 ampere, M5 | 18. Shunt, R9 |
| 4. A. C. Voltmeter, 0-150 volts, M4 | 19. Cable 1-See Table I |
| 5. Resistor, 22K, R2 | 20. Cable 2-See Table I |
| 6. ACB Indicator Light Socket, XDS1 | 21. Cable 3-See Table I |
| 7. Frequency Meter, 380-400 cycles, M3 | 22. Resistor, 396.75 ohms, R3 |
| 8. Resistor, 22K, R1 | 23. Resistor, 396.75 ohms, R4 |
| 9. ABC Indicator Light Socket, XDS2 | 24. Resistor, 396.75 ohms, R5 |
| 10. Capacitor, 0.01 uf, C1 | 25. CABLE SELECTOR Switch, S3 |
| 11. D. C. Ammeter, 0-35 amperes, M2 | 26. Resistor, 158.7 ohms, R6 |
| 12. D. C. Voltmeter, 0-35 volts, M1 | 27. Resistor, 158.7 ohms, R7 |
| 13. SPARE Fuseholder XF1 for 30A Fuse | 28. Resistor, 158.7 ohms, R8 |
| 14. Fuseholder XF1 for 30A Fuse | 29. LOAD VOLT-AMPERE Switch, S2 |
| 15. D. C. AMP Switch, S5 | 30. AC VOLTAGE-CURRENT Switch, S4 |

Figure 7-1. Control Panel, Rear View

TABLE III. TROUBLE SHOOTING CHART

Trouble	Probable Cause	Remedy
1. Test set fails to show a reading on the input d. c. meters when the POWER switch is thrown to LINE or EXT position.	a. No power supply. b. Blown 30-ampere fuse. c. CABLE SELECTOR switch in wrong position. d. Defective cables, wiring, meters, or switches in d. c. circuits of test set.	a. Check aircraft power supply line. b. Replace fuse. c. Turn POWER switch to OFF position, then select proper cable by CABLE SELECTOR switch, and repeat test. d. Make continuity check to locate faults. Make repairs or replacement as needed.
2. D. C. circuits of test set function, aircraft inverter operates, but no a. c. readings on a. c. meters.	a. No output from aircraft inverter. b. Defective cables wiring, meters, or switches in a. c. circuits of test set.	a. Check aircraft inverter. Replace as directed. b. Make continuity check to locate faults. Make repairs or replacements as needed.
3. A. C. input circuits of test set function, and aircraft inverter operates, but load cannot be applied.	a. Defective switch or resistors in load circuit of test set.	a. Make continuity check of load circuit to locate fault. Make repairs or replacements as necessary.
4. Frequency meter does not indicate.	a. Defective frequency meter or circuit.	a. Make continuity check to locate fault. Make repairs or replacement as necessary.
5. Indicator phase lights do not light up.	a. Burned out indicator neon lamps. b. Defective wiring, or switch, in frequency meter circuit.	a. Replace neon lamps. b. Make continuity check to locate fault. Make repairs or replacement as necessary.

SECTION VIII

DIAGRAMS

8-1. SCHEMATIC AND WIRING DIAGRAMS.

8-2. This section contains the following two diagrams:

Figure 8-1. Inverter Test Set TS-1409/U,
Schematic Diagram

Figure 8-2. Inverter Test Set TS-1409/U,
Wiring Diagram

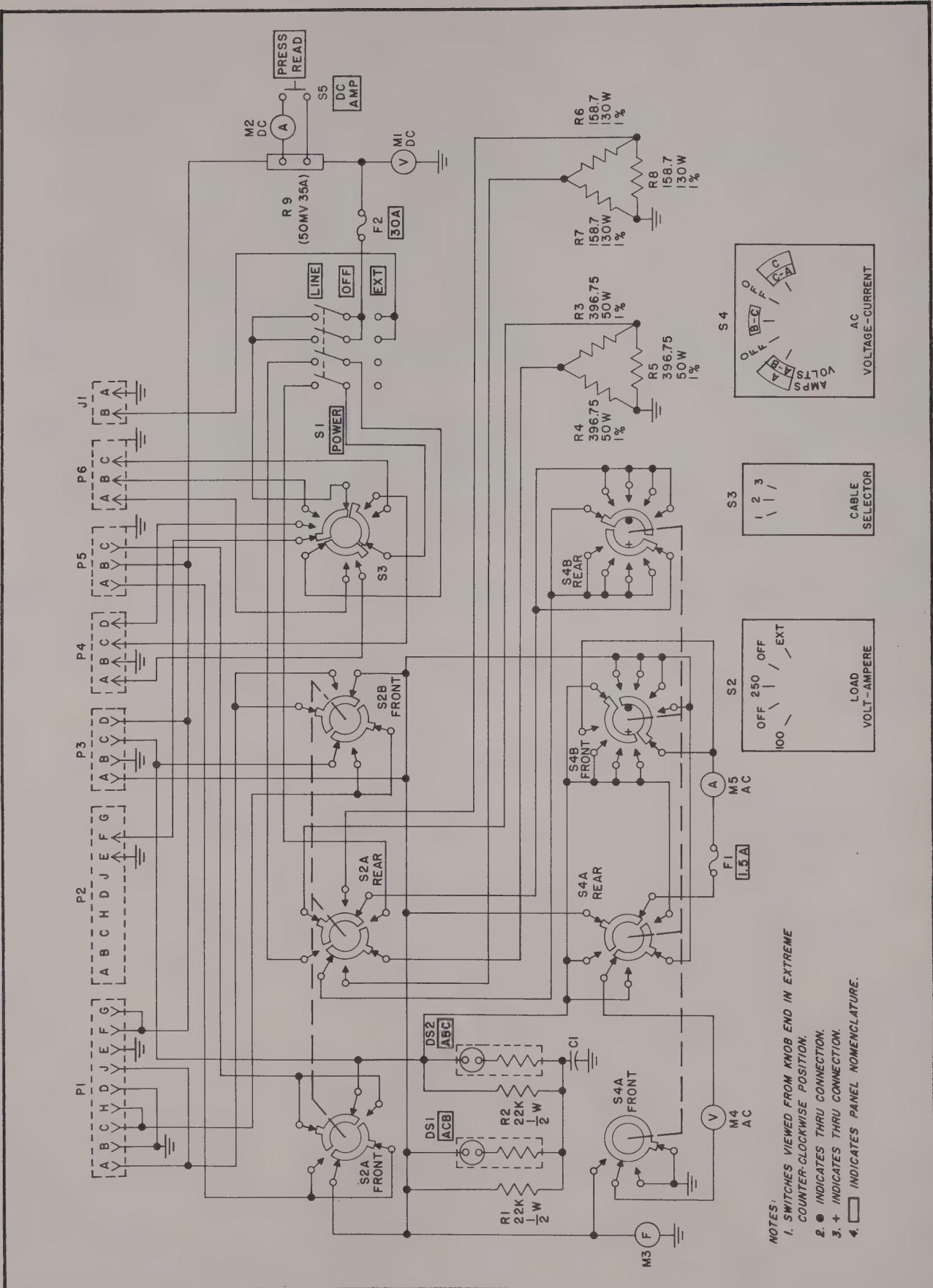


Figure 8-1. Inverter Test Set TS-1409/U, Schematic Diagram

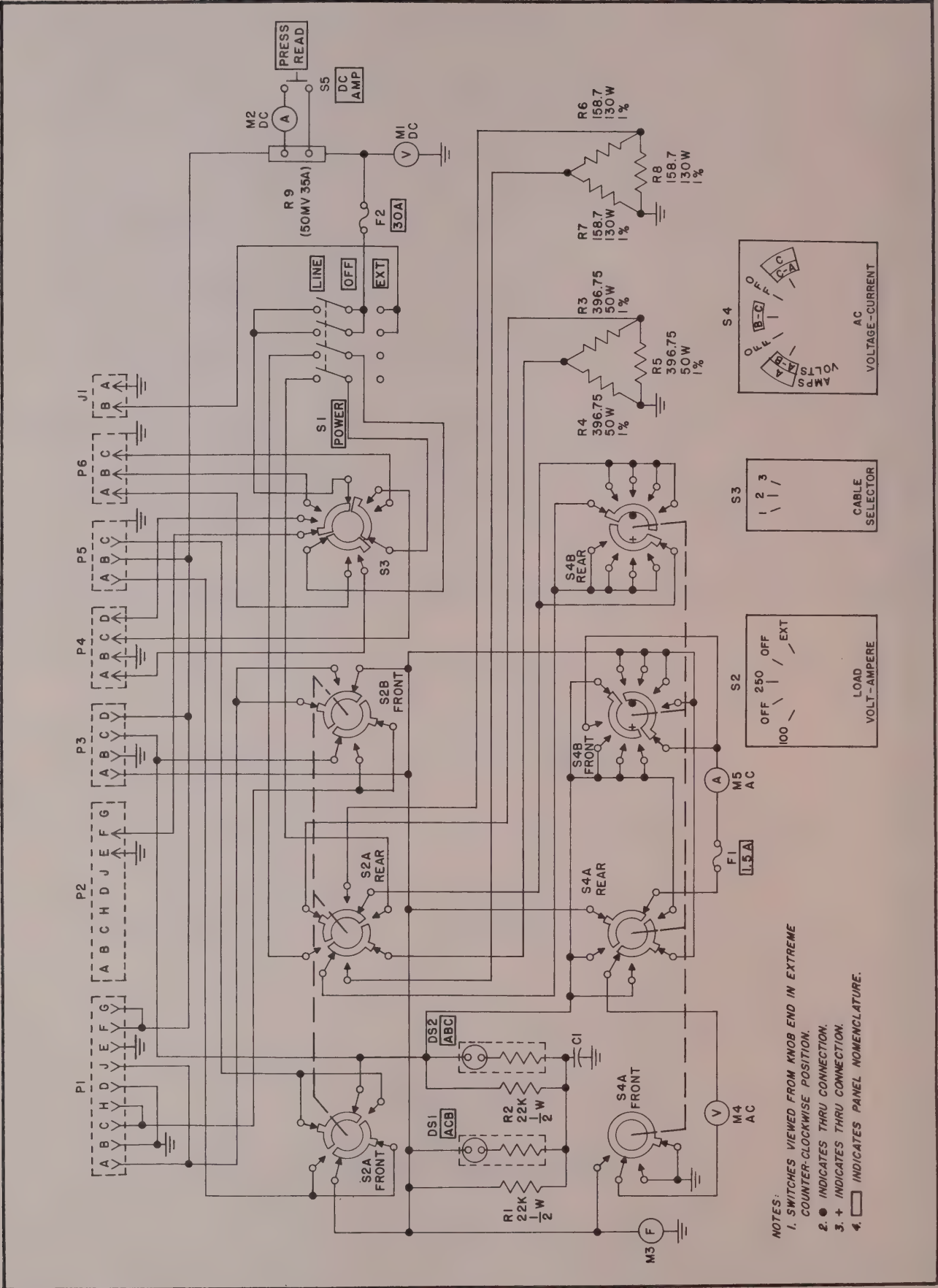


Figure 8-1. Inverter Test Set TS-1409/U, Schematic Diagram

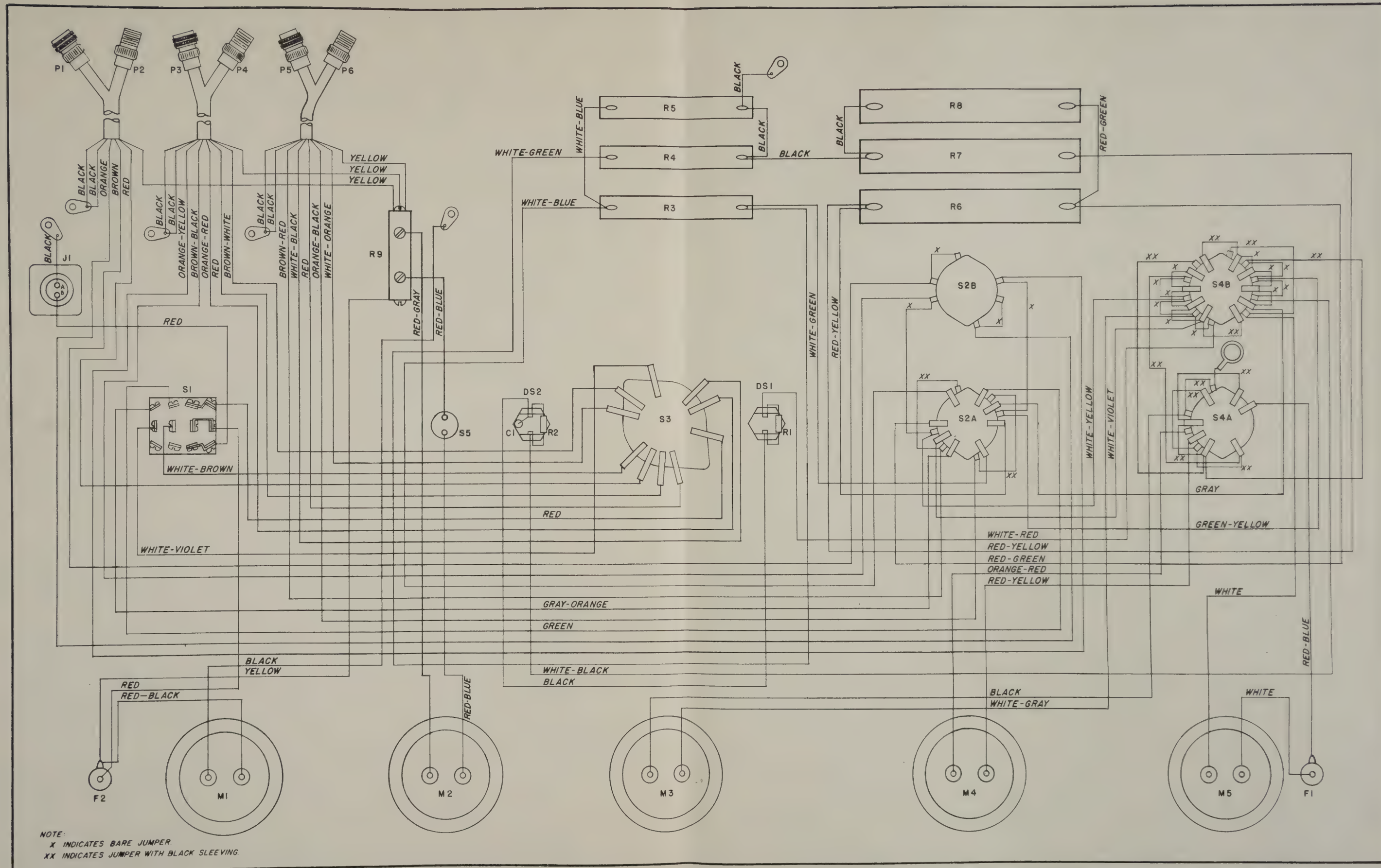


Figure 8-2. Inverter Test Set TS-1409/U, Wiring Diagram

SECTION IX
INTRODUCTION TO
ILLUSTRATED PARTS BREAKDOWN

9-1. GENERAL.

9-2. This Illustrated Parts Breakdown lists and describes the parts of the Inverter Test Set TS-1409/U (Part No. 166-4905) manufactured by Bruno-New York Industries Corporation, New York 1, N. Y. All the parts of the test set are illustrated and described in the Group Assembly Parts List (Section X). Subsequent sections cross index the parts in a Numerical Index (Section XI) and in a Reference Designation Index (Section XII).

9-3. GROUP ASSEMBLY PARTS LIST.

9-4. The Group Assembly Parts List (Section X) consists of the complete test set divided into three main groups. These three main groups or assemblies are shown by the general view of the test set (figure 1). Each assembly in the Group Assembly Parts List is followed immediately by its component parts properly indented thereunder to show their relationship to the assembly. The list is compiled in numerical order according to disassembly. Attaching parts are listed immediately following the entry of the part they attach. The symbol ---*--- is used to indicate the end of the listing of attaching parts.

9-5. The cable assemblies shown by figure 3 are made up of a continuation of the internal wiring of the test set. Each cable is 4-feet long and is provided as shown with two connector plugs. The cables are attached at the control panel with clamps so as to prevent them from being pulled off the control panel.

9-6. Part numbers are used exclusively in the Group Assembly Parts List to identify parts. In addition to part numbers of Bruno-New York Industries Corporation (166-000-0) there are MS, AN, and JAN standard numbers, and those of commercial vendors. The Federal Supply Code for Mfrs numbers used for commercial vendors supplying parts appear in parenthesis at the end of the "Description" in column 3. These numbers are listed in the VENDOR'S CODE.

9-7. The quantities listed in the "Units per Assy" column of the Group Assembly Parts List are the total quantities used at the location indicated. For the total quantities used per complete test set refer to the Numerical Index (Section X).

9-8. Since there are no blocks of serial, type, or model numbers that contain variations in part content the "Usable on Code" column in the Group Assembly Parts List is left blank.

VENDOR'S CODE

CODE NO.	VENDOR'S NAME AND ADDRESS
24446	General Electric Co. Schenectady, N. Y.
70485	Altantic India Rubber Works Chicago, Ill.
74902	International Resistor Co. Chicago, Ill.
75376	Kurz-Kasch, Inc. Dayton, Ohio
75915	Littlefuse, Inc. Des Plaines, Ill.
81073	Grayhill Co. Chicago, Ill.
95325	Bruno-New York Industries, Inc. New York, N. Y.
96312	Dialight Corp. Brooklyn, N. Y.

9-9. NUMERICAL INDEX.

9-10. The Numerical Index (Section XI) is a listing of all part numbers appearing in the Group Assembly Parts List (Section X). The listing is compiled in accordance with the following numerical part number filing system:

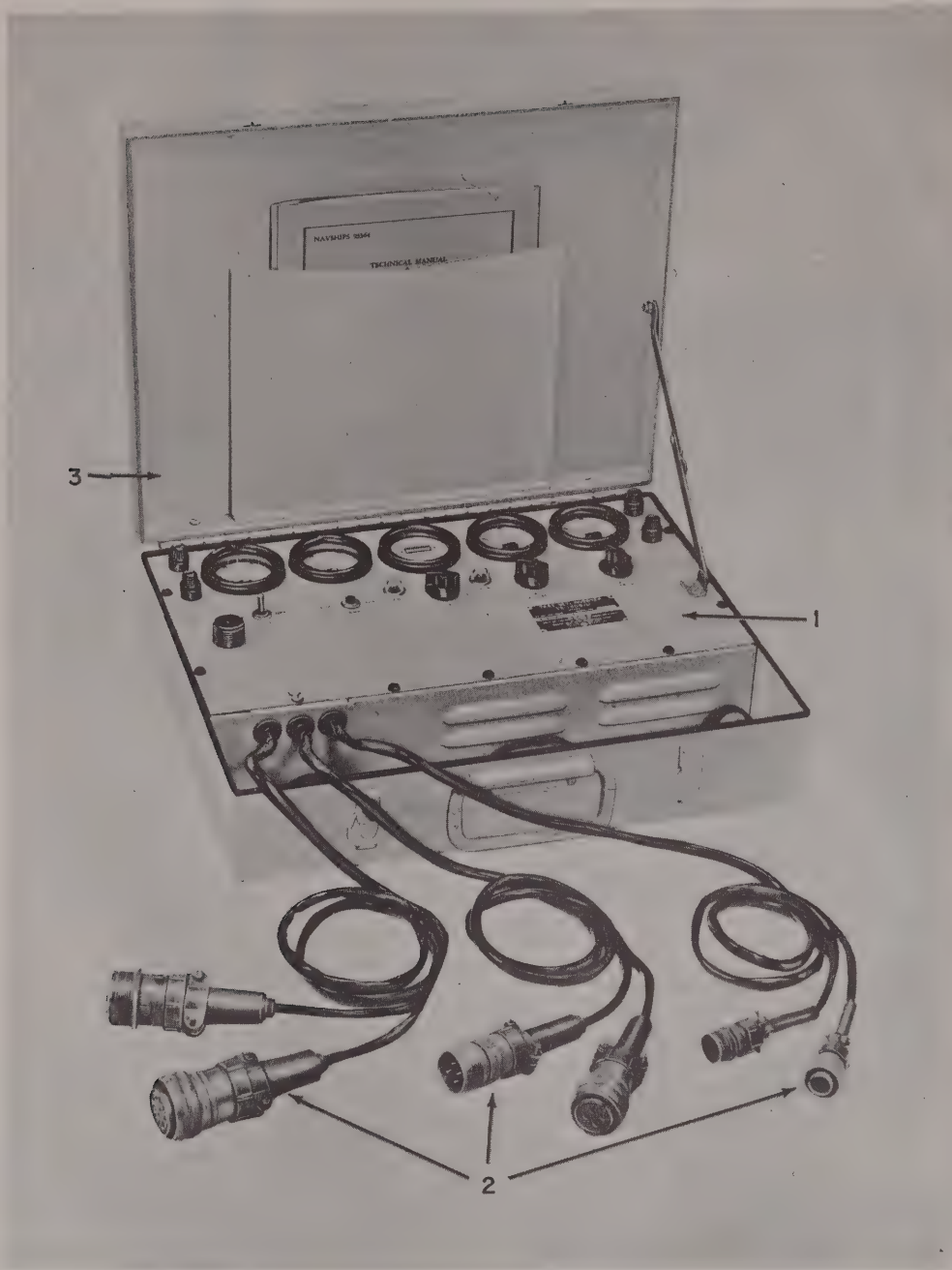
a. Part number numerical arrangement is listed in the second column of the Numerical Index and continues, one position at a time, until all part numbers are arranged in sequence.

b. The order of precedence in beginning the part number on the left-hand (first) position of the part number is as follows:

Letters A through Z (alphabetical O's are considered as numerical zeros).
Numerals 0 through 9.

c. The order of precedence in continuing the part number arrangement on the second and succeeding positions of the part number from left to right is as follows:

Space (blank column)
Diagonal (slant) /
Point (period) .
Dash (-)
Letters A through Z (alphabetical O's are considered as numerical zeros).
Numerals 0 through 9



INDEX NUMBER	NOMENCLATURE	FIGURE NUMBER
1	Control Panel Assembly	2
2	Cable Assemblies	3
3	Case and Cover Assembly	4

Figure 1. Inverter Test Set, TS-1409/U (Part No. 166-4905)

d. Spaces, diagonals, points, and dashes do not appear in the extreme left-hand position of the part number. They are used, however, in the second and succeeding positions of the part number and they take precedence over letters and numerals as indicated above.

9-11. REFERENCE DESIGNATION INDEX.

9-12. The Reference Designation Index (Section XII) lists all parts having reference designation symbols. The applicable figure and index number references are given for each such part.

9-13. CLASS CODE AND STOCK NUMBERS.

9-14. For spare parts requesting purposes, the item's stock classification code designation is given in the cross-reference indexes of the Numerical Index (Section XI) and in the Reference Designation Index (Section XII). In cases where the stock number happens to be a federal number, the class code is included in the first four numbers of the stock number. Where no stock number appears for an item, reference should be made to S-00-1 Master Cross-Reference Index. This should cross-reference the contractor's part number to stock number for items necessary to support the equipment.

9-15. HOW TO USE THE ILLUSTRATED PARTS BREAKDOWN.

9-16. When the part number, or reference designation symbol, is known and it is desired the part in an illustration, proceed as follows:

a. Find the part number in the Numerical Index (Section XI), or the reference designation symbol in the Reference Designation Index (Section XII) and note the corresponding figure and index number.

b. Turn to the figure in the Group Assembly Parts List (Section X) and look for the index number noted in step a.

9-17. When the physical location of the part is known and it is desired to find the part (stock) number, or reference designation symbol, proceed as follows:

a. Consult the list of figure titles as listed in figure 1 and choose the figure in which the part would most logically be shown. Turn to that illustration, locate the part and note the index number identifying it.

b. Refer to the Group Assembly Parts List (Section X) and find the figure and index number established in step a where the part description and part number and reference designation symbol will be found.

SECTION X
GROUP ASSEMBLY PARTS LIST

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		CONTROL PANEL ASSEMBLY		
2-	166-4801	CONTROL PANEL ASSEMBLY	1	
		(ATTACHING PARTS)		
	MS35214-40	. SCREW, Mach, pan hd, brass, black oxide, 8-32 by 3/8 in. lg	15	
	AN936A8B	LOCKWASHER, Internal teeth, cd pl, No. 8	15	
	COMM	WASHER, Flat, brass, black oxide, 3/8 in. O. D. . . by 0.174 in. I. D. by 0.016 in. thk	13	
	AN340-8	NUT, Hex, steel, No. 8	2	
		---*---		
-1	166-2803	. SHUNT, 35 amperes, 50 millivolts (R9)	1	
		(ATTACHING PARTS)		
	MS25281-8	. CLAMP, Nylon, black	1	
	166-2806-4	. SCREW, Mach, pan hd, yellow enamel, steel, . . . 8-32 by 5/8 in. lg	1	
	AN936A8B	. LOCKWASHER, Internal teeth, cd pl, No. 8	1	
	AN340-8	. NUT, Hex, steel, No. 8	1	
		---*---		
-2	AND12A-B- 396.75±1%	. RESISTOR, Fixed, wirewound, non-inductive, . . . 396.75 ohms ±1%, 50w (R3) (74902)	1	
		(ATTACHING PARTS)		
	166-2806-3	. SCREW, Mach, pan hd, yellow enamel, steel, . . . 8-32 by 3/8 in. lg	1	
	AN936A8B	. LOCKWASHER, Internal teeth, cd pl, No. 8	1	
	AN340-8	. NUT, Hex, steel, No. 8	1	
		---*---		
-3	4ND12A-B- 396.75±1%	. RESISTOR, Fixed, wirewound, non-inductive, . . . 396.75 ohms ±1%, 50w (R4) (74902)	1	
		(ATTACHING PARTS)		
	166-2806-3	. SCREW, Mach, pan hd, yellow enamel, steel, . . . 8-32 by 3/8 in. lg	2	
	AN936A8B	. LOCKWASHER, Internal teeth, cd pl, No. 8	2	
	AN340-8	. NUT, Hex, steel, No. 8	2	
		---*---		
-4	4ND12A-B- 396.75±1%	. RESISTOR, Fixed, wirewound, non-inductive, . . . 396.75 ohms ±1%, 50w (R5) (74902)	1	
		(ATTACHING PARTS)		
	166-2806-3	. SCREW, Mach, pan hd, yellow enamel, steel, . . . 8-32 by 3/8 in. lg	1	
	166-2806-4	. SCREW, Mach, pan hd, yellow enamel, steel, . . . 8-32 by 9/16 in. lg	1	
	AN936A8B	. LOCKWASHER, Internal teeth, cd pl, No. 8	1	
	AN340-8	. NUT, Hex, steel, No. 8	2	
		---*---		

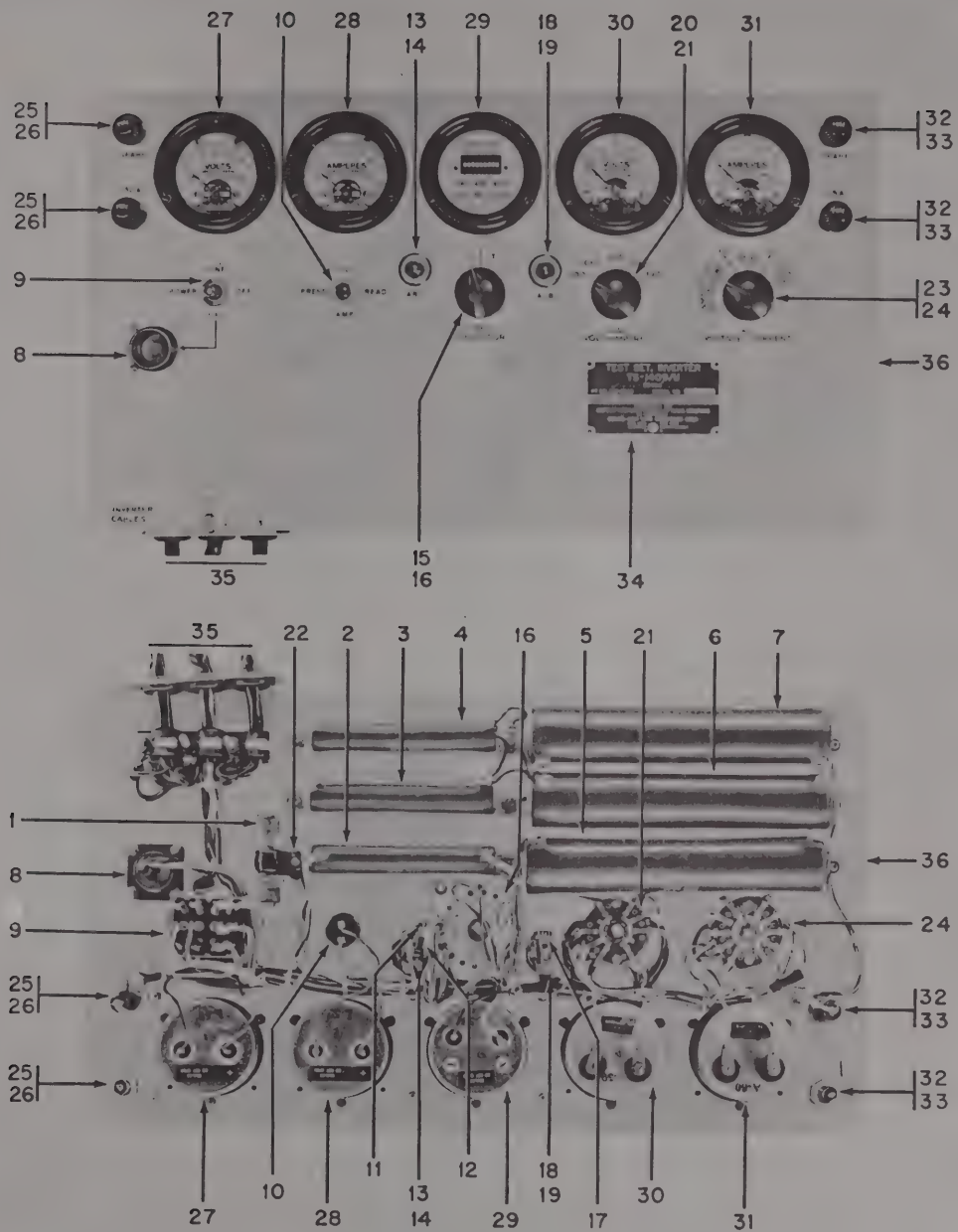


Figure 2. Control Panel Assembly

SECTION X
Group Assembly Parts List

NAVWEPS 16-35TS1409-1

FIG. & INDEX NO.	PART NO.	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE				
1	2	3	4	5	6	7		
CONTROL PANEL ASSEMBLY (cont)								
2-5	6-1/2NH12A-B- 158.7±1%	. RESISTOR, Fixed, wirewound, non-inductive, 158.7 ohms ±1%, 130w (R6) (74902)	1					
	166-2806-3	(ATTACHING PARTS) . SCREW, Mach, pan hd, yellow enamel, steel, 8-32 by 3/8 in. lg	1					
	AN936A8B	. LOCKWASHER, Internal teeth, cd pl, No. 8	1					
	AN340-8	. NUT, Hex, steel, No. 8	1					
		---*---						
-6	6-1/2NH12A-B- 158.7±1%	. RESISTOR, Fixed, wirewound, non-inductive, 158.7 ohms ±1%, 130w (R7) (74902)	1					
	166-2806-3	(ATTACHING PARTS) . SCREW, Mach, pan hd, yellow enamel, steel, 8-32 by 3/8 in. lg	1					
	AN936A8B	. LOCKWASHER, Internal teeth, cd pl, No. 8	1					
	AN340-8	. NUT, Hex, steel, No. 8	1					
		---*---						
-7	6-1/2NH12A-B- 158.7±1%	. RESISTOR, Fixed, wirewound, non-inductive 158.7 ohms, ±1%, 130w (R8) (74902)	1					
	166-2806-3	(ATTACHING PARTS) . SCREW, Mach, pan hd, yellow enamel, steel, 8-32 by 3/8 in. lg	1					
	AN936A8B	. LOCKWASHER, Internal teeth, cd pl, No. 8	1					
	AN340-8	. NUT, Hex, steel, No. 8	1					
		---*---						
-8	MS3102A16-11P	. CONNECTOR RECEPTACLE (J1)	1					
	166-2806-1	(ATTACHING PARTS) . SCREW, Mach, pan hd, yellow enamel, brass, 4-40 by 7/16 in. lg	4					
	AN936A4B	. LOCKWASHER, Internal teeth, cd pl, No. 4	4					
	AN340-4	. NUT, Hex, steel, cd pl, No. 4	4					
		---*---						
-9	166-2802	. SWITCH, Toggle, 3-position (S1)	1					
-10	4001	. SWITCH, Push-button, momentary action, normally . open (S5) (81073)	1					
-11	CP10A3EE103M	. CAPACITOR, Fixed, paper dielectric, 0.01 uf (C1) .	1					
	MS35206-22	(ATTACHING PARTS) . SCREW, Mach, pan hd, bradd, cd pl, 6-32 by 3/16 in. lg	1					
	AN936A6B	. LOCKWASHER, Internal teeth, cd pl, No. 6	1					
	AN340-6	. NUT, Hex, steel, No. 6	1					
		---*---						
-12	RC20GF223K	. RESISTOR, Fixed, composition, 22K (R1)	1					
-13	NE51	. LAMP, Neon, Phase ABC (DS2) (24446)	1					
-14	166-2508	. LAMPHOLDER, Indicator light, phase ABC (XDS2) . .	1					
-15	S657-3L-BB	. KNOB, Pointer, with white line (75366)	1					
-16	166-2507	. SWITCH, Rotary, 3-section, 3-position (S3)	1					
-17	RC20GF223K	. RESISTOR, Fixed, composition, 22K (R2)	1					
-18	NE51	. LAMP, Neon, Phase ABC (DS1) (24446)	1					
-19	952708-937	. LAMPHOLDER, Indicator light, phase ACB, (XDS1) (96312)	1					
-20	S657-3L-BB	. KNOB, Pointer, with white line (75376)	1					
-21	166-2506	. SWITCH, Rotary, 2-section, 5-position, (S2)	1					
-22	166-230S	. LUG, Terminal	1					

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		CONTROL PANEL ASSEMBLY (cont)		
2-23	S657-3L-BB	. KNOB, Pointer, with white line (75376)	1	
-24	166-2505	. SWITCH, Rotary, 2-section, 5-position, (S4)	1	
-25	313030	. FUSE, Cartridge, 30 amp (F2) (75915)	2	
-26	342012	. FUSEHOLDER (XF2) (75915)	2	
-27	166-2502	. VOLTMETER, D. C. 0-35 volts (M1)	1	
		(ATTACHING PARTS)		
	166-1303	. DISC, Meter closure	1	
	AN515B4R10	. SCREW, Mach, rd hd, brass, black oxide, 4-40 by 5/8 in. lg	3	
	AN936-4B	. LOCKWASHER, Split, brass, No. 4	3	
	AN340-4	. NUT, Hex, steel, No. 4 ---*---	3	
-28	166-2501	. AMMETER, D. C. 0-35 amps (M2)	1	
		(ATTACHING PARTS)		
	166-1303	. DISC, Meter closure	1	
	AN515B4R10	. SCREW, Mach, rd hd, brass, black oxide, 4-40 by 5/8 in. lg	1	
	AN936-4B	. LOCKWASHER, Split, brass, No. 4	3	
	AN340-4	. NUT, Hex, steel, No. 4 ---*---	3	
-29	166-2500	. FREQUENCY METER, 380-420 cps (M3)	1	
		(ATTACHING PARTS)		
	AN515B4R10	. SCREW, Mach, rd hd, brass, black oxide, 4-40 by 5/8 in. lg	3	
	AN936-4B	. LOCKWASHER, Split, brass, No. 4	3	
	AN340-4	. NUT, Hex, steel, No. 4 ---*---	3	
-30	166-2503	. VOLTMETER, A. C. 0-150 volts (M4)	1	
		(ATTACHING PARTS)		
	166-1303	. DISC, Meter Closure	1	
	AN515B4R10	. SCREW, Mach, rd hd, brass, black oxide, 4-40 by 5/8 in. lg	3	
	AN936-4B	. LOCKWASHER, Split, brass, No. 4	3	
	AN340-4	. NUT, Hex, steel, No. 4 ---*---	3	
-31	166-2504	. AMMETER, A. C. 0-15 amps (M5)	1	
		(ATTACHING PARTS)		
	166-1303	. DISC, Meter Closure	1	
	AN515B4R10	. SCREW, Mach, rd hd, brass black oxide, 4-40 by 5/8 in. lg	3	
	AN936-4B	. LOCKWASHER, Split, brass, No. 4	3	
	AN340-4	. NUT, Hex, steel, No. 4 ---*---	3	
-32	31201-5	. FUSE, Cartridge 1.5 amp (F1) (75915)	2	
-33	342012	. FUSEHOLDER (XF1) (75915)	2	
-34	166-2100	. NAMEPLATE, Aluminum, 2 in. by 3 in. by 0.15 thk .	1	
		(ATTACHING PARTS)		
	MS35214-12	. SCREW, Mach, pan hd, brass, black oxide, 4-40 by 1/4 in. lg	4	
	AN936A4B	. LOCKWASHER, Internal teeth, No. 4 ---*---	4	
-35	No Number	. CABLE ASSEMBLIES (See figure 3)	1	
-36	166-4701	. PANEL, Steel, yellow enamel	1	

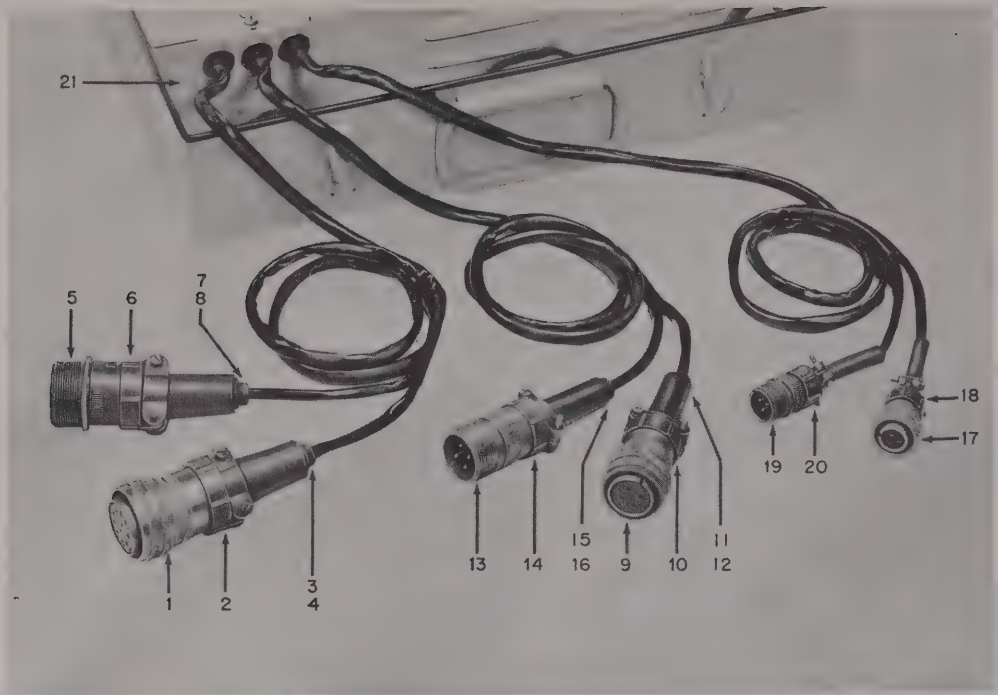


Figure 3. Cable Assemblies

FIG. & INDEX NO.	PART NO.	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
		1 2 3 4 5 6 7		
		CABLE ASSEMBLIES		
3-	No Number	CABLE ASSEMBLIES (See figure 2 for next higher assembly)	1	
-1	MS3107A24-20S	. CONNECTOR PLUG, (P1)	1	
-2	AN3057-16A	. ADAPTOR, for P1	1	
-3	AN3420-6	. BUSHING, Rubber, for P1 adapter	1	
-4	AN3420-8	. BUSHING, Rubber, for P1 adapter	1	
-5	MS3101A24-20P	. CONNECTOR PLUG (P2)	1	
-6	AN3057-16A	. ADAPTOR, for P2	1	
-7	AN3420-6	. BUSHING, Rubber, for P2 adaptor	1	
-8	AN3420-8	. BUSHING, Rubber, for P2 adaptor	1	
-9	MS3107A20-4S	. CONNECTOR PLUG (P3)	1	
-10	AN3057-12A	. ADAPTOR, for P3	1	
-11	AN3420-6	. BUSHING, Rubber, for P3 adaptor	1	
-12	AN3420-8	. BUSHING, Rubber, for P3 adaptor	1	
-13	MS3101A20-4P	. CONNECTOR PLUG (P4)	1	
-14	AN3057-12A	. ADAPTOR, for P4	1	
-15	AN3420-6	. BUSHING, Rubber, for P4 adaptor	1	
-16	AN3420-8	. BUSHING, Rubber, for P4 adaptor	1	
-17	MS3107A14S-7S	. CONNECTOR PLUG (P5)	1	
-18	AN3057-6A	. ADAPTOR, for P5	1	
-19	MS3101A14S-7P	. CONNECTOR PLUG (P6)	1	
-20	AN3057-6A	. ADAPTOR, for P6	1	

FIG. & INDEX NO.	PART NO.	DESCRIPTION							UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7		
3-21	166-2301	CABLE ASSEMBLIES (cont)								
		. BRACKET							1	
		(ATTACHING PARTS)								
	166-1304	. PLATE, Threaded							1	
	166-2806-3	. SCREW, Mach, pan hd, yellow enamel, steel							1	
		8-32 by 3/8 in. lg								
	AN936A8B	. LOCKWASHER, Internal teeth, cd pl, No. 8							2	
	COMM	. WASHER, Flat, brass, black oxide, 3/8 OD by							2	
		0.174 ID by 0.916 thk								
	166-2804-5	. SCREW, Mach, pan hd, yellow enamel, brass							3	
		8-32 by 3/4 in. lg								
	AN936A8B	. LOCKWASHER, Internal teeth, cd pl, No. 8							6	
	AN340-8	. NUT, Hex, steel, No. 8							6	
	MS21919D-67	. CLAMP							3	
	166-2302	. CHANNEL							1	
		---*---								

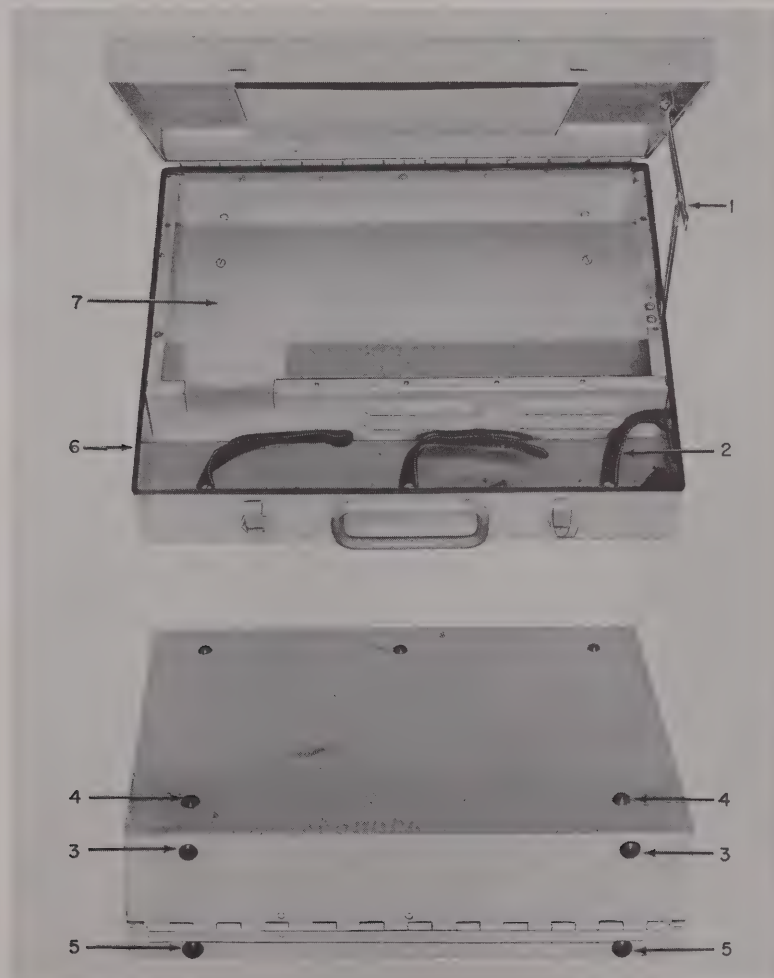


Figure 4. Case and Cover Assembly

SECTION X
Group Assembly Parts List

NAVWEPS 16-35TS1409-1

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		CASE AND COVER ASSEMBLY		
4-	166-3700	CASE AND COVER ASSEMBLY	1	
-1	166-2800	. BRACE ASSEMBLY.	1	
		(ATTACHING PARTS)		
	MS35208-25	. SCREW, Mach, pan hd, steel, cd pl, 8-32 by 3/8 in. lg	1	
		----*----		
-2	166-2801	. STRAP, Nylon, 3/4 in. w by 11 in. lg	3	
		(ATTACHING PARTS)		
	166-2806-3	. SCREW, Mach, pan hd, yellow enamel, steel, 8-32 by 3/8 in. lg	3	
	AN936A8B	. LOCKWASHER, Internal teeth, cd pl, No. 8	3	
	COMM	. WASHER, Flat, brass, black oxide, 3/8 in. OD by 0.174 in. ID by 0.049 in. thk	3	
	868-2	. BUMPER, Rubber, threaded insert, 5/8 in. dia . . . (70485)	3	
		----*----		
-3	868-2	. BUMPER, Rubber, threaded insert, 5/8 in. dia . . . (70485)	2	
		(ATTACHING PARTS)		
	166-2806-3	. SCREW, Mach, pan hd, yellow enamel, steel 8-32 by 3/8 in. lg	2	
	AN936A8B	. LOCKWASHER, Internal teeth, cd pl, No. 8	2	
	COMM	. WASHER, Flat, brass, black oxide, 3/8 in. OD . . . by 0.174 in. ID by 0.016 in. thk	2	
	166-1201-2	. SPACER, 5/8 in. OD by 0.174 in. ID by 0.125 in. thk	2	
		----*----		
-4	868-2	. BUMPER, Rubber, threaded insert, 5/8 in. dia . . . (70485)	2	
		(ATTACHING PARTS)		
	166-2806-2	. SCREW, Mach, pan hd, yellow enamel, brass, 8-32 by 1/4 in. lg	2	
	AN936A8B	. LOCKWASHER, Internal teeth, cd pl, No. 8	2	
	COMM	. WASHER, Flat, brass, black oxide, 3/8 in. OD . . . by 0.174 in. ID by 0.049 in. thk	2	
	166-1201-1	. SPACER, 5/8 in. OD by 0.174 in. ID by 0.031 in. thk ----*----	2	
-5	868-2	. BUMPER, Rubber, threaded insert, 5/8 in. dia . . . (70485)	2	
		(ATTACHING PARTS)		
	166-2806-2	. SCREW, Mach, pan hd, yellow enamel, brass, 8-32 by 1/4 in. lg	2	
	AN936A8B	. LOCKWASHER, Internal teeth, cd pl, No. 8	2	
	COMM	. WASHER, Flat, brass, black oxide, 3/8 in. OD . . . by 0.174 in. ID by 0.049 in. thk	2	
		----*----		
-6	166-2400	. GASKET, Rubber, 66 in. lg	1	
-7	166-4806	. CASE AND COVER	1	

SECTION XI
NUMERICAL INDEX

Class Code or Stock No.	Part No.	Source Code	Fig. and Index No.	Qty Per Arti- cle
	AN3057-6A		3-18	2
	AN3057-12A		3-10	2
	AN3057-16A		3-2	2
	AN340-4		2-8	19
	AN340-6		2-11	1
	AN340-8		2-	23
	AN3420-6		3-3	4
	AN3420-8		3-4	4
	AN515B4R10		2-27	12
	AN936-4B		2-27	15
	AN936A4B		2-8	8
	AN936A6B		2-11	1
	AN936A8B		2-	41
	CP10A3EE103M		2-11	1
	MS21919-D67		3-21	3
	MS25281-8		2-1	1
	MS3101A14S-7P		3-19	1
	MS3101A20-4P		3-13	1
	MS3101A24-20P		3-5	1
	MS3102A16-11P		2-8	1
	MS3107A14S-7S		3-17	1
	MS3107A20-4S		3-9	1
	MS3107A24-20S		3-1	1
	MS35206-22		2-11	1
	MS35208-25		4-1	1
	MS35214-12		2-34	4
	MS35214-40		2-	15
	NE51		2-13	2
	RC20GF223K		2-12	2
	S657-3L-BB		2-15	3
	166-1201-1		4-4	2
	166-1201-2		4-3	2
	166-1303		2-27	4
	166-1304		3-21	1
	166-2100		2-34	1

Class Code or Stock No.	Part No.	Source Code	Fig. and Index No.	Qty Per Arti- cle
	166-2301		3-21	1
	166-2302		3-21	1
	166-2303		2-22	2
	166-2400		4-6	1
	166-2500		2-29	1
	166-2501		2-28	1
	166-2502		2-27	1
	166-2504		2-31	1
	166-2505		2-24	1
	166-2506		2-21	1
	166-2507		2-16	1
	166-2508		2-14	1
	166-2800		4-1	1
	166-2801		4-2	3
	166-2802		2-9	1
	166-2803		2-1	1
	166-2804-5		3-21	3
	166-2806-1		2-8	4
	166-2806-2		4-4	4
	166-2806-3		2-2	14
	166-2806-4		2-1	2
	166-3700		4-	1
	166-4701		2-35	1
	166-4801		2-	1
	166-4806		4-7	1
	31201.5		2-32	2
	313030		2-25	2
	342012		2-26	4
	4ND12A-B- 396.75 \pm 1%		2-2	3
	4001		2-10	1
	6-1/2NH12A-B- 158.7 \pm 1%		2-5	3
	868-2		4-2	9
	952708-937		2-19	1

SECTION XII
REFERENCE DESIGNATION INDEX

Reference Designation	Figure Index	Class Code or Stock No.	Part No.
C1	2-11		CP10A3EE103M
DS1	2-18		NE51
DS2	2-13		NE51
F1	2-32		31201.5
F2	2-25		313030
J1	2-8		MS3102A16-11P
M1	2-27		166-2502
M2	2-28		166-2501
M3	2-29		166-2500
M4	2-30		166-2503
M5	2-31		166-2504
P1	3-1		MS3107A24-20S
P2	3-5		MS3101A24-20P
P3	3-9		MS3107A20-4S
P4	3-13		MS3101A20-4P
P5	3-17		MS3107A14S-7S
P6	3-19		MS3101A14S-7P
R1	2-12		RC20GF223K
R2	2-17		RC20GF223K
R3	2-2		4ND12A-B-396.75 $\pm 1\%$
R4	2-3		4ND12A-B-396.75 $\pm 1\%$
R5	2-4		4ND12A-B-396.75 $\pm 1\%$
R6	2-5		6-1/2NH12A-B-158.7 $\pm 1\%$
R7	2-6		6-1/2NH12A-B-158.7 $\pm 1\%$
R8	2-7		6-1/2NH12A-B-158.7 $\pm 1\%$
R9	2-1		166-2803
S1	2-9		166-2802
S2	3-16		166-2507
S3	2-21		166-2506
S4	2-24		166-2505
S5	2-10		4001
XDS1	2-19		952708-937
XDS2	2-14		166-2508
XF1	2-33		342012
XF2	2-26		342012

